

MEDICAL WASTE MANAGEMENT EDUCATIONAL AND TRAINING INTERVENTION PROGRAM IN ZAGAZIG UNIVERSITY HOSPITALS

By

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Abstract

Introduction: Medical waste poses a substantial health risk to health care professionals, patients, waste workers, and the environment. Proper handling, treatment and disposal of biomedical waste play a vital role in hospital infection control program. The strongest factor influencing the degree of compliance to proper waste management guidelines are education and training. **Aim of work:** To assess knowledge, attitude and practice of health care workers regarding proper waste management, to estimate frequency of exposure to sharps and to design a specifically tailored hospital-based educational and training program about proper medical waste management. **Materials and methods:** An interventional study was conducted on 388 health care workers. All workers completed questionnaires to measure socio-demographic and occupational characteristics and to assess the knowledge and attitude of health care workers (HCWs) about proper waste management. A checklist to assess self-protection practice regarding health care waste management was also used. A training program about proper medical waste management was given to all workers and evaluation of the program was done after 3 months. **Results:** The doctors and nurses have good knowledge and attitude, but average to low practice; auxiliary workers have low to average knowledge, good attitude and bad practice. The educational and training program was effective and had impact of enhance knowledge, attitude and practice. The socio-demographic characters had minimal effect on the percentage of change of knowledge, attitude and practice among doctors and nurses and with no effect among workers. No correlation was found between knowledge attitude and practice. **Conclusion:** Our intervention program was effective and had impact on enhancing knowledge, attitude and practice among the studied group of health care workers.

Keywords: Health care workers, Medical waste management, Intervention program, knowledge, Attitude and Practice.

Introduction

Hospitals are health institutions providing patient care services. It is the duty of hospital and healthcare centers to take care of public health. This may directly be through patient care or indirectly by ensuring a clean, healthy environment for their employees and the community (Patil and Pokhrel, 2005). In the process of delivery of healthcare, waste is generated. Medical waste is any solid or liquid waste generated during diagnosis, treatment, immunization or during medical research (HCWM, 2011).

Medical waste is a by-product of healthcare that includes sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals, medical devices and radioactive materials (El-Sharkawy, 2009), also human tissues or body parts, sharps and other infectious materials (Baveja et al., 2000). A hidden waste management time bomb is ticking away, and health and safety professionals should understand its full dimensions. Medical waste and sharps waste pose a substantial health risk to health care professionals, patients, waste workers, and the environment (Kunik, 2011).

Universal precautions are a simple set of effective practices designed to protect health workers and patients from infection with a range of pathogens including blood borne viruses (WHO, 2003) or they are infection control guidelines designed to protect workers from exposure to diseases spread by blood and certain body fluids (CCOHS, 2007).

Proper handling, treatment and disposal of biomedical waste play a vital role in hospital infection control program (WHO, 2005). The strongest factors influencing the degree of compliance to proper waste management guidelines are education and training (Botelho, 2011).

Aim of work

To assess knowledge, attitude and practice of health care workers regarding proper waste management, to estimate frequency of exposure to sharps and to design a specifically tailored hospital-based educational and training program about proper medical waste management.

Materials and methods

- **Study design:** An intervention study was conducted.

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- **Place and duration of the study:** This study was conducted at Zagazig University Hospitals which include nine hospitals from January 2013 to June 2014.
 - **Study Sample:** The study population included all Health Care Workers (HCWs) working at Zagazig university hospitals, Sharkia Governorate. The total number of HCWs at the time of this study was 4592, divided as follows: 423 resident physicians, 600 house officers, 2400 nurses, 110 lab technicians, 200 radiology technicians and 850 auxiliary workers including waste collectors and crushing and incinerator workers. The sample size was calculated through Epi-Info (Epidemiological information package) software version 6.1 (Dean et al. 1994). Taking into account the total number of HCWs according to the following collected data by Mustafa, 2009 study, the percentage of adequate practice was 18.9% of studied population improved after intervention to 24.5% with confidence level 95% and degree of precision 80%. The sample plus 10% for refusal rate was (399). The final sample was (388) after exclusion of non-responders and dropped out cases.
 - **Sampling method:** a stratified random sample technique with proportional allocation was to recruit participants from different departments and from different occupational strata as: 89 physicians, 235 nurses and technicians and 64 auxiliary workers.
 - **Study methods:** The study started with conducting situation analysis, frequency of sharps injury, blood and body fluids (BBF) exposure, and needs assessment, then a pre and post questionnaires and checklists were specifically designed in order to measure the effect of medical waste management educational and training program in term of knowledge, attitude and practice of HCWs.
- Tools of the study:**
- 1-Questionnaire:** Two parts Arabic translated questionnaire was used

- 1st part consisted of questions on personal and professional data including age, sex, qualification, occupation, department, work experience; assess needs, and frequency and consequence of sharps exposure (Abd El Hamed et al., 2010).

- 2nd part to assess knowledge, attitude of HCWs about proper waste management, included 37 questions: 20 questions for assessing knowledge and 17 for assessing attitude (WHO, 2007; Radha, 2012; Sharma et al., 2013 and Sanjeev, 2014). All questions in the questionnaire were close-ended.

2- Checklist: Checklist for health care waste management practice (The Self-Assessment Project Partnership, 1999). It assessed self-protection practice regarding health care waste management and also assessed practice of following the guidelines of health care waste management.

3- Interventional program:

A specifically designed educational and training program about proper medical waste management according to gap analysis was conducted for all HCWs sample. The interview

was conducted during their available time, through training sessions. The knowledge and attitude enhancements were the expected outcomes of this intervention, also, the improvement of the quality of practice regarding the medical waste management. After three months, we evaluated this intervention by using the same tools to estimate program impact on HCWs knowledge, attitude and practice by comparing pre and posttest.

Consent

The study group was informed about the nature and the purpose of the study, and verbal consent was taken before interview. Privacy, confidentiality and anonymity were respected, only one copy of participant names and corresponding ID numbers was produced, for which only the investigator had access to.

Ethical approval

The Institutional Review Board (IRB) ethical committee of Zagazig University, faculty of Medicine approved the study protocol. Official permissions were obtained from the Community Medicine Department, the director of

Zagazig University Hospitals, and the IRB Ethical Committee of the college

Data management

Data was presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, means and standard deviations for quantitative variables. Correlations were done by Pearson's correlation. Qualitative categorical variables were compared using chi-square (χ^2) and for paired data Mc Nemar and sign tests were used as suitable. The test results were considered significant when p -value <0.05 and highly significant if p -value <0.001 . The collected data was analysed using SPSS program (Statistical Package of Social Services) version 20 (IBM Corp, 2011) .

Scoring system:

Each right answer, positive attitude and proper practice was given one mark and the false, negative or improper one was given zero mark and we calculated total knowledge, attitude and practice by summation of all items of knowledge, attitude and practice

Knowing 60% or more of universal precautions (UP) considered as correct

knowledge regarding UP.

For total knowledge, attitude and practice (KAP) we took cutoff 60% as adequate KAP.

Regarding the attitude, in positive attitude questions (Agree and Strongly Agree considered as a positive attitude and taking 3 and 2 degree respectively but Disagree and Strongly disagree or not knowing considered as a negative attitude and taking 1,0 and 0 degree respectively. The opposite considered for negative attitude questions.

We calculated percentage of change by calculating the difference between pre and post then divided it by pre, then we took cutoff (median) for estimating the adequate percentage of change as adequate percentage of change in knowledge, attitude and practice were above the median (Pope, 2008).

Results

Our study showed that majority of the studied physicians (83.2%) and more than half of the studied nurses (58.7%) aged ≤ 30 years with a mean age of $(28.7 \pm 3.1$ & 30.7 ± 6.7 respectively). The majority of the studied nurses were female (96.2%) while about one

third of studied physicians (30.4%) were female, the majority of auxiliary workers (78.1%) were male, about two third of them aged more than 35 years with mean age of 40.18 ± 6.92 . Regarding experience; the majority

of the studied physicians (80.9%) had work experience ≤ 5 years, while about half of studied nurses (48.9%) had work experience >5 years. The majority of auxiliary workers (70.3%) had work experience ≥ 15 years.

Table 1: Frequency distribution of exposure to blood and body fluid and post exposure measures among exposed studied HCWs.

	Physicians (No=89) No (%)	Nurses (No=235) No (%)	Workers (No=42) No (%)
HBV Vaccination	22 (24.7)	51 (21.7)	15 (23.4)
Exposure to blood or internal body fluids last year	54 (60.60)	149 (63.4)	42 (65.6)
Frequency of exposure to BBF among exposed HCWs	(No=54)	(No=149)	(No=42)
■ Once	13 (24.05)	24 (16.1)	15 (35.8)
■ More than once	32 (59.25)	103 (69.1)	21 (50.0)
■ Can't remember	9 (16.7)	22 (14.8)	6 (14.2)
Post exposure report			
■ Reported	11 (20.3)	28 (18.7)	13 (30.9)
■ NO	43 (79.7)	121 (81.3)	29 (69.1)
Post exposure hand washing			
■ Yes	15 (27.7)	43 (28.8)	28 (66.7)
■ NO	39 (72.3)	106 (71.2)	14 (33.3)
Lab investigations after exposure			
■ Yes	40 (74.1)	98 (65.8)	31 (73.8)
■ NO	14 (25.9)	51 (34.2)	11 (26.2)
Lab Results	(No=40)	(No=98)	(No=31)
■ Negative	38 (95.0)	70 (71.5)	24 (77.5)
■ HBV	0 (0.0)	12 (12.2)	1 (3.2)
■ HCV	2 (5.0)	16 (16.3)	6 (19.3)

BBF: blood and body fluids HCWs: health care workers

Table 1 showed that only one fifth of studied physicians, nurses and auxiliary workers had HBV vaccination (24.7%, 21.7% and 23.4% respectively), more than half of them exposed more than one time to blood and body fluids. One third of exposed physicians, nurses and auxiliary workers washed their hand after exposure (27.7%, 28.8% and 33.3%). Also, this table shows that after exposure to BBF 5.0% of physicians, 16.3% of nurses and 19.3% of auxiliary workers had positive HCV, 12.2% of nurses and 3.2% of auxiliary workers had positive HBV, only less than 30.0% of exposed physicians and nurses reported their exposure.

Table 2: Frequency distribution of total Knowledge, Attitude and Practice as regard medical waste among studied HCWs at pre and post intervention.

	Physicians				p	Nurses				p	Auxiliary workers				p
	Pre		Post			Pre		Post			Pre		Post		
	No	%	No	%		No	%	No	%		No	%	No	%	
Total Knowledge															
Adequate	71	79.2	82	92.1	<0.001**	176	74.8	207	88.08	<0.001**	27	42.1	33	51.5	>0.05
Inadequate	28	20.8	7	7.9		59	25.2	28	11.92		37	57.9	31	48.5	
Total Attitude															
Positive	76	85.3	85	95.5	<0.001**	194	82.5	221	94.04	<0.001**	41	64.0	52	81.25	<0.05*
Negative	23	14.7	4	4.5		41	17.5	14	5.96		23	36.0	12	18.75	
Total Practice															
Good	31	34.8	49	55.05	<0.001**	74	31.4	105	44.6	<0.001**	19	29.6	26	40.6	>0.05
Bad	58	65.2	40	44.95		161	68.6	130	55.4		45	70.4	38	59.4	

*: Significant

** : Highly significant

Table 2 shows significant difference between pre and post intervention regarding knowledge, attitude and practice of medical waste disposal among physicians and nurses. The highest improvement among physicians was in practice (34.8% to 55.05%) while for nurses the highest improvement was in knowledge (74.8% to 88.08%). For auxiliary workers, no significant difference between pre and post intervention as regard adequate total knowledge and practice of medical waste disposal, however attitude showed significant change after intervention (64.0% to 81.25%).

Table 3: Adequate percentage of change of Knowledge, Attitude and Practice (KAP) as regards medical waste management among HCWs.

	Physicians		Nurses		Auxiliary workers	
	No	%	No	%	No	%
Total Knowledge						
Adequate improve	52	58.4	114	48.5	33	51.5
Inadequate improve	37	41.6	121	51.5	31	48.5
Total Attitude						
Adequate improve	47	52.8	94	40.0	32	50.0
Inadequate improve	42	47.2	141	60.0	32	50.0
Total Practice						
Adequate improve	48	53.9	80	34.04	32	50.0
Inadequate improve	41	46.1	155	65.96	32	50.0

Table 3 shows that KAP adequately improved among physicians, nurses and auxiliary workers after intervention. Regarding knowledge improvement (58.4%, 48.5% and 51.5% respectively), for attitude (52.8%, 40.0% and 50.0% respectively), and for practice (53.9%, 34.04% and 50.0% respectively).

Table 4: Correlation between percentages of change of Knowledge, Attitude and Practice as regard medical waste management, age and experience of studied HCWs.

	Physicians				Nurses				Auxiliary workers			
	Age		Experience		Age		Experience		Age		Experience	
	r	p	r	p	r	p	r	p	r	p	r	p
Knowledge	-0.303	0.004*	-0.082	0.442	-0.068	0.303	0.051	0.43	-0.222	0.078	-0.153	0.227
Attitude	0.028	0.791	-0.137	0.201	-0.069	0.289	-0.045	0.496	-0.129	0.311	-0.071	0.576
Practice	-0.008	0.941	0.058	0.589	-0.029	0.658	-0.026	0.694	-0.161	0.203	-0.128	0.314

*: Significant

Table 4 shows that there was significant negative correlation between percentage of change of knowledge and age among physicians only.

Table 5: Correlation between percentage of change of Knowledge, Attitude and Practice(KAP) of medical waste management among HCWs.

Occupation		Knowledge		Practice	
		r	p	r	p
Physicians	Attitude	-0.018	0.868	0.001	0.994
	Practice	0.024	0.823		
Nurses	Attitude	0.033	0.619	0.020	0.761
	Practice	0.054	0.406		
Auxiliary workers	Attitude	0.005	0.998	-0.059	0.642
	Practice	-0.021	0.870		

Table 5 shows that there were no significant associations between percentage of change of knowledge, attitude or practice among all HCWs.

Discussion

Our results revealed that about two third of studied physicians, nurses and workers were exposed to blood or internal body fluids (60.6%, 63.4% and 65.6% respectively) more than half of them exposed more than one time (Table 1). These findings agree with the results obtained by Askarian et al. (2008) as they reported that, proportion of HCWs experiencing BBF exposure in developing countries ranged from 55% to 82%. Those percentages of HCWs experienced at least one percutaneous injury in the prior year of study, compared to only 9% of nurses in the United States in one

study (Gillen et al. 2003). They relayed this high prevalence of BBF exposure in developing countries among HCWs on insufficiency of personal protective equipments, unavailability of safe sharp devices, inadequate knowledge about exposure risks and lack of adherence to universal precautions.

In our study, we noticed that after exposure to BBF; 5.0% of physicians, 16.3% of nurses and 19.3% of auxiliary workers had positive HCV, 12.2% of nurses and 3.2% of auxiliary workers had positive HBV (Table 1).This is in agreement with surveillance done by CNSSN, 2003 which declare that the prevalence of HCV among HCWs

exposed to BBF in Canadian Hospitals was much higher than the prevalence of HIV and HBV among identified and tested source patients (7.6% versus 2.6% and 1.8%) respectively.

But in contrarily, Rabaud et al., 2000 reported that only half of occupational exposure to blood victims sought to determine the serological status of the source patient for HIV, HCV and hepatitis B virus immediately after accident. Only 40% and 31% of occupational exposure to blood victims checked their own HIV and HCV sero-status 3 and 6 months after occupational exposure to blood.

In this study, less than 30.0% of exposed physicians and nurses reported their exposure, while the percent was higher among auxiliary workers (30.9%) (Table1). These findings are in agreement with a study done by Rabaud et al. (2000) who found that under reporting and fear from segregation from work keep the incidence of BBF exposure among HCWs further beyond the actual numbers, approximately one half (48.5%) of all occupational exposure to blood reported. "Good local antiseptics immediately after

the accident" was the reason most often given to justify of non reporting (Rabaud et al., 2000).

Knowledge, Attitude and Practice studies on biomedical waste management are very important as they are required to know the current awareness and practices and also, to form educational program which resolves the gap between current states and the target.

Our study showed significant difference between pre and post intervention. The highest improvement among physicians was in practice while as regards nurses, the highest improvement was in knowledge (Table 2). This may rely on good pre intervention Knowledge and relatively average Practice among physicians and wrong believe among them about the Practice of medical waste management as it is not concerning them so they don't need to enhance their practice. In agreement to our findings Abd El Aziz, 2008 found better knowledge and compliance to universal precautions and hand washing among physicians than nurses in Ain shams hospital.

In contrast to our findings, a study done by Hakim et al., 2013, reported that nurses comparatively had better practice of HCW management than the housekeeping and technical staff, also, nurses disposed of blood-contaminated fomites more correctly than physicians. Moreover, the percentage of nurses showing satisfactory overall Practice scores was significantly higher than that of physicians.

Regarding auxiliary workers, this study showed low to average general Knowledge, Attitude and Practice, there was no significant difference between pre and post intervention as regards adequate total Knowledge and Practice of medical waste disposal; however Attitude showed significant change after intervention (Table 2). In contrast to our findings, Elnour et al., 2015 reported that there was a highly significant improvement of nursing and sanitation staff Knowledge total score regarding HCW management immediately after implementation of an educational intervention program. There was also a significant improvement of nursing and sanitation staff practices total score.

Our results revealed that there was a significant negative correlation between percentage of change of Knowledge and age among physicians only, and no significant correlation with years of experience (Table 4). This may be due to fresh Knowledge and ability to gain Knowledge and skills.

In agreement with our study, a work done by Madhukumar and Ramesh, 2012 who reported that low level of Knowledge is mainly attributed to deficient training and also to relatively low educational level of the staff. Training of both the technical and the nontechnical staffs is critical for the proper and appropriate management of biomedical waste. It was found that the younger nurses learn management better than the old nursing staffs.

Also, in agreement with our work, a study done by Suchitra and Devi, 2007 who suggested that yearly educational modules will help in retention of Knowledge in the area of nosocomial infections and the prevention of infections. It would also translate in a behavioral change of Attitudes and Practices that would help in reducing the incidence of nosocomial infections.

Our findings also agreed with Madhukumar and Ramesh, 2012 who found that low level of Knowledge is mainly attributed to poor training facilities and also to relatively low educational level and higher age of the staffs.

In contrast to our finding Pittet et al., 2006 detected that years of experience in the hospital significantly correlated to increased Knowledge, Attitudes and Practices among the various categories of staff but this did not translate into good clinical practice in the ward.

Our study results also disagreed with the study of Huston, 2008 who found that increases in age and experience showed better Knowledge, and they reported positive effect of educational level and training on the level of Knowledge.

Our study showed that there was no significant association between percentage of change of Knowledge, Attitude or Practice among HCWs (Table 5). This was in agreement with a previous study which showed that Knowledge, Attitude and Practices had no correlations with each other (Matur et al., 2011). In contrast, Madhukumar

and Ramesh, 2012 and Sangappa, 2013 found that Knowledge on biomedical waste management had improved waste disposal practices.

Conclusion and recommendations

We can conclude that HCWs exposed frequently to hazardous wastes and BBF need training and education program regarding proper waste management. Doctors and nurses have good Knowledge and Attitude but average to low Practice, while workers have low to average Knowledge, good Attitude and bad Practice. Our educational program was effective and had impact on enhancing KAP among all HCWs. Managerial support is highly needed and better tools should be provided to enhance health care workers KAP as regards medical waste management.

Conflict of interest

The authors declare that there is no conflict of interest.

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